

# Defenders Lab 1: Comparing Two Medicines


## Introduction

In this lab, you will be playing an online videogame, **Defenders**. In this game, there is an outbreak of new viruses. Two potential medicines are currently being tested to stop the viruses from spreading. For simplicity, we will refer to them as **Med R** and **Med B**. Both have shown some evidence of success when compared against a placebo. However, neither is 100% effective and more testing is needed to determine which treatment is best. Your task is to determine the best treatment strategy to stop the spread of the viruses.

Go to the web site: <https://stat2games.sites.grinnell.edu>.

Click on the **Defenders** tab, then click **Play Defenders**

Note: **This site may take a few minutes to load.**

- Input your own **Player ID**: This will be on the web. **Do not use a player name that will identify you.** However, make sure you print your Player ID on this worksheet. Player ID \_\_\_\_\_.
- Your instructor will tell you your **Group ID** \_\_\_\_\_. **Every person in the class should have an identical Group ID.**
- Click the yellow play button: 
- Click on the blue land to complete the **Tutorial**.



## TASK #1: Collecting Level 1 Information

After entering Level 1, select **Pillshooter Fast Lvl1** with **Med R** at Location 1 and **Pillshooter Fast Lvl1** with **Med B** at Location 3.

\*Pillshooter Fast Lvl1 is the upgrade of Pillshooter. The upgrade action can be completed after you choose the medicine for the turrets.

**Wave1:** Click the **Start Wave** button and record your results for **Wave 1** (the first Round) below.

**Med R Effectiveness** \_\_\_\_\_

**Med B Effectiveness** \_\_\_\_\_

**Wave2:** Using the same settings, click the **Start Wave** button and record your results after **Wave 2** below.

**Med R Effectiveness** \_\_\_\_\_

**Med B Effectiveness** \_\_\_\_\_

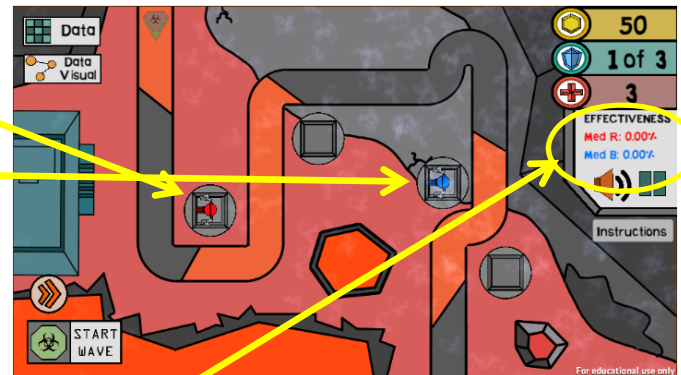
**Strategy for Wave 3:** After Wave 2, hover over the Start Wave button and you will see that there will be 5 Red and 25 Blue Enemies in Wave 3. Do not make any changes to the location or upgrades in each turret. Provide a strategy *only based upon changing the type of medicine* for **Wave 3**. Will you use Med R for both locations, Med B for both locations, or some other combination?

**Location 1 Med** \_\_\_\_ **Location 3 Med** \_\_\_\_

**Play Wave 3** and record your results:

**Remaining Funds at the end of Level 1** \_\_\_\_\_

**Med R Effectiveness** \_\_\_\_\_ **Med B Effectiveness** \_\_\_\_\_



## TASK #2: Conduct a Hypothesis Test for Level 1:

Conduct a hypothesis test to determine if there is a difference between the effectiveness of the two medicines.

**Gather Data:** There are two ways to do this

- Click the **Show Data** button and sum your results for Level 1.
- (slightly easier) Click on the **Data Visuals** button, and choose **Bar Chart** for the dropdown that currently displays "Dot Plots" and sum the total number of destroyed and shot for each medicine.

**Med R:** Destroyed \_\_\_\_\_ Shot \_\_\_\_\_

**Med B:** Destroyed \_\_\_\_\_ Shot \_\_\_\_\_

**Med R Effectiveness = Destroyed/Shot = \_\_\_\_\_**

**Med B Effectiveness = Destroyed/Shot = \_\_\_\_\_**

Write the research question of interest. Make sure to identify whether you are testing proportions, counts or averages. State your null and alternative hypothesis:

Describe an appropriate population for this study.

What are the population parameters of interest?

Calculate the p-value from your data and state your conclusions below. After completing Level 1, can you conclude there is a difference in the effectiveness of the medicines? How confident are you in your conclusions?

### TASK #3: Use data visualizations and charts to explore the data

Click on the **Data Visuals** button, and choose **Percent Destroyed** for the dropdown that currently displays “Total Shots” and check the **Show Averages** check box. Hover over each of the points representing averages on the graph and record the following:

**Med R:** Percent Red Enemy Destroyed \_\_\_\_\_ Percent Blue Enemy Destroyed \_\_\_\_\_

**Med B:** Percent Red Enemy Destroyed \_\_\_\_\_ Percent Blue Enemy Destroyed \_\_\_\_\_

**\*Note that Percent Destroyed is the same as the effectiveness of the medicine against that enemy.**

In the **Data Visuals**, change **Dot Plot** to **Bar Chart** and record the following information:

<b>Med R</b>	Destroyed	Missed	Total Shots
Red Enemy			
Blue Enemy			
Total			

<b>Med B</b>	Destroyed	Missed	Total Shots
Red Enemy			
Blue Enemy			
Total			

What information do these graphs provide? In particular, does there appear to be a pattern between the effectiveness of the medicine and the type of enemy? Knowing that a majority of Wave 3 enemies are blue, should you make any changes to your strategy? If so, what medicines will you use?

**Location 1 Med** \_\_\_\_ **Location 3 Med** \_\_\_\_

Instructor's signature \_\_\_\_\_

#### More Graphs

**Graph 1:** Go to the app that shows data for every player: [http://shiny.grinnell.edu/Defenders\\_Visualizations/](http://shiny.grinnell.edu/Defenders_Visualizations/). Create a graph (using only Level 1 data) that provides evidence that the effectiveness of the medicines depends on the type of enemy. Take a screenshot of the graph and post it below.

**Graph 2:** Create a graph (using only Level 1 data) that helps you determine whether the effectiveness of the medicines depends upon the wave. Take a screenshot of the graph, post it below, and state your conclusions.

**Graph 3:** Create a graph (using only Level 1 data) that helps you determine whether the effectiveness of the medicines depends upon the type of upgrade. Take a screenshot of the graph, post it below, and state your conclusions.

**TASK #4:**

With this additional information provided from Task #3, design a strategy that you believe would give the best performance for Level 1. List the medicine type (Med R or Med B) and upgrade (Fast, Far, None) for each location you use for each wave.

Wave 1	Wave 2	Wave 3
Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____
Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____
Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____
Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____	Location ___ Med___ Upgrade_____

**Remaining Funds at the end of Level 1 \_\_\_\_\_ Health \_\_\_\_\_**

Did your performance (total funds and health at the end of the level) improve? Describe why you believe the strategy used in Task #4 is better than (or worse) than the one used in Task #1 or Task #3.

In making a decision about which medicine to use, how valuable is a statistical test? What are potential issues with using only statistics in making such a decision? What, if any, other considerations should be used?

**Task #5:** Read the ASA's statement on statistical significance and p-values,

<https://amstat.tandfonline.com/doi/pdf/10.1080/00031305.2016.1154108?needAccess=true>. Selected one of the six principles and write one to two paragraphs discussing this principle. Then, briefly discuss how that principle applies to this Defenders activity.